



## Potential economic benefits of adapting agricultural production systems to future climate change

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**Year:** 2010  
**Journal:** Environmental Management. 45 (3): 577-589

### Abstract:

Potential economic impacts of future climate change on crop enterprise net returns and annual net farm income (NFI) are evaluated for small and large representative farms in Flathead Valley in Northwest Montana. Crop enterprise net returns and NFI in an historical climate period (1960-2005) and future climate period (2006-2050) are compared when agricultural production systems (APSs) are adapted to future climate change. Climate conditions in the future climate period are based on the A1B, B1, and A2 CO<sub>2</sub> emission scenarios from the Intergovernmental Panel on Climate Change Fourth Assessment Report. Steps in the evaluation include: (1) specifying crop enterprises and APSs (i.e., combinations of crop enterprises) in consultation with local producers; (2) simulating crop yields for two soils, crop prices, crop enterprise costs, and NFIs for APSs; (3) determining the dominant APS in the historical and future climate periods in terms of NFI; and (4) determining whether NFI for the dominant APS in the historical climate period is superior to NFI for the dominant APS in the future climate period. Crop yields are simulated using the Environmental/Policy Integrated Climate (EPIC) model and dominance comparisons for NFI are based on the stochastic efficiency with respect to a function (SERF) criterion. Probability distributions that best fit the EPIC-simulated crop yields are used to simulate 100 values for crop yields for the two soils in the historical and future climate periods. Best-fitting probability distributions for historical inflation-adjusted crop prices and specified triangular probability distributions for crop enterprise costs are used to simulate 100 values for crop prices and crop enterprise costs. Averaged over all crop enterprises, farm sizes, and soil types, simulated net return per ha averaged over all crop enterprises decreased 24% and simulated mean NFI for APSs decreased 57% between the historical and future climate periods. Although adapting APSs to future climate change is advantageous (i.e., NFI with adaptation is superior to NFI without adaptation based on SERF), in six of the nine cases in which adaptation is advantageous, NFI with adaptation in the future climate period is inferior to NFI in the historical climate period. Therefore, adaptation of APSs to future climate change in Flathead Valley is insufficient to offset the adverse impacts on NFI of such change.

**Source:** <http://dx.doi.org/10.1007/s00267-010-9427-0>

### Resource Description

#### Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES), Other Climate Scenario

**Special Report on Emissions Scenarios (SRES) Scenario:** SRES A1, SRES A2, SRES B1

# Climate Change and Human Health Literature Portal

**Other Climate Scenario:** Environmental/Policy Integrated Climate (EPIC) model

**Exposure :** ☒

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Security, Food/Water Security, Meteorological Factors, Precipitation, Solar Radiation, Temperature

**Food/Water Security:** Agricultural Productivity

**Temperature:** Extreme Cold, Extreme Heat, Fluctuations

**Geographic Feature:** ☒

resource focuses on specific type of geography

Other Geographical Feature

**Other Geographical Feature :** Farmland

**Geographic Location:** ☒

resource focuses on specific location

United States

**Health Impact:** ☒

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

**Mitigation/Adaptation:** ☒

mitigation or adaptation strategy is a focus of resource

Adaptation

**Model/Methodology:** ☒

type of model used or methodology development is a focus of resource

Cost/Economic, Exposure Change Prediction, Methodology

**Resource Type:** ☒

format or standard characteristic of resource

Research Article

**Socioeconomic Scenario:** SES scenarios

**Timescale:** ☒

time period studied

Medium-Term (10-50 years)

**Vulnerability/Impact Assessment:** ☒

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content